Description

SYSTEM AND METHOD FOR REAL TIME GENERATING, PRESENTING, DISPLAYING AND PAYING UTILITY BILLS ONLINE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001]   This application claims priority from provisional application No. 60/474,851, filed June 2, 2003 by Dr. Henry Crichlow.This application is also related to pending U.S. Patent Application Publication No. US2002/0018545A1 for "Method and Apparatus for Reading a Meter and Providing Customer Service Via the Internet," No. 10/016,049 for "Method and System for Establishing Internet Websites for Utility Meters Allowing Utility Meters to be Read Over the Internet," and No. 10/033,667 for "Method and System for Energy Management Using Intelligent Agents Over the Internet."

BACKGROUND OF INVENTION

[0002] This invention relates to a system for continuously providing information on the internet of the power usage at a utility's electric meter. In particular, it relates a system where there is an internet site at which the power usage at the meter can be viewed and at which the utility company can post pricing information for the use of power at said meter, an automatic meter reader that provides continuous information on the power being used at the meter, means for sending information between said automatic meter reader and the internet site, so that the utility can send pricing information to the automatic meter reader and, using that pricing information, the automatic meter reader continuously calculates charges for power usage and can send those charges to the internet site where they can be posted.

[0003] The electric utility industry is a major industry nationally and worldwide. It collects several hundred billion dollars annually in revenues. The major focal point in the system is the energy usage bill generated monthly for each user. For the industry, the meter is the cash register that allows the utility to bill and collect revenue from the users, usually on a monthly basis. Hundreds of millions of dollars are spent annually by the utilities to generate, mail out,

and collect their bills. This facet of the operation is a capital and labor-intensive operation and streamlining the operation and making the billing operations more efficient would save substantial amounts of money.

[0004] The advent of the internet has made it possible for bills to be displayed and paid on the internet, making the billing operation cheaper and more productive for both the company and the customer. The internet is especially conducive to conducting electronic transactions and the design, ubiquitous nature and standard interfaces, i.e. browsers, of the internet make this medium ideally suited for paying bills.

[0005] Recently, improvements have been made in the billing process using the internet. Information on power usage that has been collected manually or remotely by the utility is used to compute the customer's monthly bill. The bill is displayed on the company's website so that the user may view it and pay it online if he wishes to. But even when a utility has installed an automatic meter reading (AMR) system at the customer's site, the bill is calculated periodically, normally once each month, but occasionally at shorter intervals. Most or all of the prior billing inventions focus primarily on the last leg of the utility billing chain,

the bill presentment phase. The meter phase systems to date either provide information only on a daily update and only in the case of extremely expensive commercial and industrial systems is data available in real time to the individual customers. There is no residential system which can provide real time data today. There is a major need for the integration of the metered data, its collection, recognition, storage, energy use tariff selection, and eventually its presentment and display. It would be advantageous for some customers, however, if they could know on a continuous basis what they owe for power being used so that they can alter operations accordingly. This is especially true when a utility has different rates at different times of the day or during peak usage. In addition, continuous billing may help to detect the theft of power or the loss of power due to shorts or the loss of insulation.

[0006] DESCRIPTION OF PRIOR ART

[0007] U.S. Patent No. 5,699,276 describes a utility meter interface apparatus which has a standard computer system of some size and complexity and a utility meter both connected between a utility company and customer. This significant computer is connected to the utility meter and provides an interface between a communication network

and a device located inside the home. The computer can communicate with the interface in several different forms.

[0008] U.S. Patent No.5,699,528 presents a bill delivery and payment system whereby users access a server computer on a communications network like the Internet to obtain bill information and pay bills. The patent also indicates the use of email to provide bill information.

[0009] In U.S. Patent No. 6,578,015, there is disclosed a computer-implemented method of presenting an electronic bill from a biller to a customer over a computer network from a payment database.

[0010] U.S. Patent No. 6,618,709 provides a very complex method, process and computer architecture which can monitor resource usage via a global computer network including the use of databases, associated resource meters, recorders and communications systems.

[0011] U.S. Patent No. 6,385,595 by Visa discusses an electronic statement presentment (ESP) system which replaces the preparation and mailing of paper statements and invoices from a biller with electronic delivery.

[0012] Patent WO02061536First USA Bank describes a bill payment system and method that enables a customer payor to make payment to a payee in a networked environment

using a credit card, revolving credit, or other credit account. The payment system may provide for online receipt and review of bills, and may allow a customer payor to optionally select one or more alternative secondary accounts for payment in the event that payment cannot be made from a primary account.

[0013] Existing companies Ibill.com (www.ibill.com), and Transpoint.com (www.transpoint.com), have developed bill presentment processes. In these processes, the billing company essentially takes a company's paper bill that has been previously computed and makes an electronic equivalent which it displays online in HTML or similar format. The customer can log on to the internet, see the bill, and elect to pay it in some predetermined manner. The presenting company essentially replaces the U.S. Post Office as an intermediary between the utility company and its customer. The bill presented is updated once a month.

[0014] Credit card companies, (e.g., www.visa.com and www.mastercard.com) have long had the ability to update the purchases of their customers in real time to monitor usage and to control potential abuse and fraud. The need in the utility industry is not as critical but there is still a great desire to minimize costs and to provide better cus-

tomer services. An additional demand in the electric power industry arises from the new industry practice where the power company's tariffs are based on the time of use (TOU pricing). This development creates the need for a real time billing process to help the customer optimize energy use by shifting power use to low cost time periods and to allow the utility to schedule power generation and distribution more economically.

[0015] Ameresco (www.ameresco.com/e-supply_compservices.asp), a service company, proposes a system which gathers and analyses information about energy use and allows the customer to process and pay utility bills online. This system gathers the data from the utility and allows the customer to access data and print reports through a secure Internet site.

[0016] Duke Energy, a Houston electric utility, allows its customers to read their energy use daily at a secure website. In the optimal situation, the system allows the user to see data updated at 15 minute intervals.

SUMMARY OF INVENTION

[0017] This invention provides an improvement in utility billing technology whereby information is available in real time

showing the consumer the instantaneous use of energy and its costs. The user can then modify and control the use of energy more effectively and thereby control costs and use the power he purchases more efficiently. Real time cost information is becoming increasing important because the expectation in the industry is that power use will be deregulated and energy costs will vary with time of use (TOU pricing), e.g., energy will cost more in peak times. Because prices can change hourly for commercial and industrial customers, it is critical that both the user and the seller of power have access to real time data continuously, the user for cost minimization and the seller for planning.

[0018] This invention allows the orderly development and expansion of the utility industry and for better strategic planning and implementation nationally since both utilities and consumers will have a better control of their energy utilization.

[0019] This invention allows the customer to be alerted when certain prescribed limits on use are reached during the month so that the consumer can react and plan. By implementing the processes of this invention, a bill can be generated from real time data, the bill can be displayed online

and both the user and the utility can be aware of energy use and energy costs simultaneously. The user can have the option of paying the bill at any time.

[0020] This invention addresses the full energy use chain from electric flow quantification at the meter to bill computation, bill presentment, and bill payment, and provides an economical, efficient, and easily deployable method and process. An embodiment of the present invention provides a method and a system for obtaining energy use data from a customer meter and displaying the computed electric bill online in real time as a webpage.

[0021] A further objective of this invention is to provide a means whereby the customer energy use can be displayed online as a webpage.

[0022] Another specific objective is to provide a means whereby this web page can be displayed by using hyper text markup language (HTML) code or extensible markup language (XML) code for a browser to view.

[0023] Another specific objective is to provide a means whereby the webpage is presented and displayed at the company website on the company server.

[0024] Another specific objective is to provide a means whereby the webpage is presented and displayed using the same

identical universal resource locator (URL) to locate the on-line bill even though the IP address of the AMR device and the actual webpage may change with time.

[0025] Another specific objective is to provide a means whereby the webpage is presented and displayed at the individual customer meter in which the customer intelligent meter behaves as a micro-server.

[0026] Another specific objective is to provide a means whereby the online bill can be displayed and made available at both the company server and the individual customer meter site simultaneously.

[0027] Another specific objective is to provide a means whereby the energy use data is updated continuously online in real time.

[0028] Another specific objective is to provide a means whereby the energy bill is updated continuously online in real time.

[0029] Another specific objective is to provide a means whereby the energy user can be alerted if there are changes in use his patterns and violations of his preset use limits.

[0030] Another specific objective is to provide a means whereby the customer has the option to pay the bill online.

BRIEF DESCRIPTION OF DRAWINGS

[0031] Figure 1 is a block diagram illustrating a certain presently

preferred embodiment of the process of this invention.

[0032] Figure 2 illustrates the process of maintaining a single online computer address or URL for user to access the webpage.

[0033] Figure 3 is a diagram illustrating a billing process according to this invention, where utility servers are used to compute the online billing information.

[0034] Figure 4 is a diagram illustrating a billing process according to this invention, where an intelligent meter is used to compute the online billing information.

[0035] Figure 5 shows a typical online electric bill displayed as a web page.

[0036] Figure 6 shows the energy use data displayed online as a web page.

[0037] Figure 7 shows 3 possible modes of operation of this invention.

[0038] Figure 8 describes a Server Mode of this invention.

[0039] Figure 9 describes a Client Mode of this invention.

[0040] Figure 10 describes a Hybrid Mode of this invention.

[0041] Figure 11 shows a typical residential billing algorithm.

[0042] Figure 12 shows a calculation procedure for a typical bill.

[0043] Figure 13 shows a system with a visual liquid crystal display (LCD) window to provide information to the customer.

DETAILED DESCRIPTION

[0044] The present invention provides a method and system for acquiring real time meter data from a customer meter and making this data available online showing a real time usage webpage and also an online bill which can be paid online or offline by the customer/user. By "real time" it is meant that the data is presented with no more than a 60 minute delay from the time it is generated, preferably with no more than 5 minute delay, and most preferably with no delay.

[0045] This invention connects the user and the generator more closely and allows an integration of the power industry in a manner which heretofore has been unavailable and provides for a paradigm shift in efficiencies for the customer and the generator.

[0046] The invention can be applied in several embodiments. There are 3 possible modes for practicing the system of this invention, but these do not limit the possible methodologies in which the system can be implemented. A person versed in the technology can see additional

combinations and permutations of these applications.

[0047] Figure 7 shows the three embodiment modes of this invention. In the Server Mode, the meter device reads the energy data and sends the information to the server where the billing is computed, presented, and displayed, and payment made possible. In the Client Mode, an automatic meter reader (AMR) reads the energy data and computes the billing; the bill is presented, displayed, and payment may be made at the client's microserver. The meter itself in this embodiment functions as a computer microserver, albeit a small server, but with all the typical features of an internet server. The Hybrid Mode is a combination of the Server Mode and the Client Mode, where data is made available at both the meter micro-server site and at the company server simultaneously. Detailed steps for the Server Mode, the Client Mode, and the Hybrid Mode are shown in Figures 8, 9, and 10, respectively.

[0048] In all three modes, the bill is computed at the AMR. This is an advantage because it gives another level of backup and security. Utility computer systems can and do go down, but the AMR will still be operational because it operates independently of the utility computer system. The AMR can incorporate a card reader so that payment by credit

card or debit card may be made at the AMR. Access to the AMR may be protected by password, passcard, or other security measures, such as typing in a code on a cell phone. Also, the AMR customer can have a third party monitor his energy usage without having to rely upon the utility for this service. The AMR may also give an audible, visual or other type of alarm when pricing information changes, so that the customer can adjust his energy use if he wishes to.

[0049] This invention may be used with any utility service, including electric power, gas, water, and other types of utility commodities.

[0050] Referring to Figure 1, there are three basic sequential phases involved in the application of the invention. In the first phase, the meter data is read or acquired by an automatic meter reader (AMR). An AMR is a commercially available device that generates continuous digital information of the power usage at the meter. The AMR includes a microprocessor that can store information and make calculations. In the next step, the meter data is either utilized at the AMR device or it is transferred to a remote server at the utility location, or both. The bill is computed by the AMR and may also be computed by the

remote server. In the third step, the computed data is made available for display and payment either online, at the meter, or at both locations.

[0051] Referring to Figures 2 and 3, there are three types of AMR devices, the residential AMR *1*, the commercial AMR *10* and the industrial AMR *11*. The AMR 1 may be connected in the field to either analog meters which are the older type meters or to digital meters which are newer and more sophisticated. A typical AMR*1* is connected by a communication interface *2* to an internet server provider (ISP) *3*. The internet network *4* allows AMR *1*, which is identified by a dynamic (i.e., it changes on every new logon), or static, (i.e., it never changes) internet protocol (IP) address *5*, to be reached online through the internet or the world wide web (www), which is one of many networks on the internet. In one embodiment of the invention, AMR 1 may communicate directly with the utility system 14 without going through internet network 4 first. This may be accomplished, for example by means of a direct phone link or a wireless link, such as a radio link. A computer translation system *8*, usually referred to in the information technology (IT) industry as a domain name service (DNS) translation, allows a dynamic translation of the current IP

address *5* of AMR *1* to a fixed address maintained by the translation address server *8.* This process allows the AMR to be always reached by the same unchanged internet identification (ID) at all times by the customers *6* and *7.*

[0052] Referring to Figure 3, the ISP *3* connects the AMR device *1* to the utility enterprise server *14.* Software display programs *12* and billing algorithms *13* are resident in the utility servers *14.* In one embodiment of the invention, these programs compute the billing data and display it at a utility website.

[0053] Referring to Figure 4, in the Client Mode, the real time billing information *15* is computed at the meter device *1* using billing algorithm *13* which is part of the software embedded in micro-server device *1.* This bill data and associated payment options *15* are then made available to customers *6* and *7* to review online with personal computers (PCs). In the Client Mode, illustrated by Figure 4, the utility enterprise servers are used optionally for backup archiving and bill presentation.

[0054] Referring to Figure 5, the billing information, which is displayed either at microserver device *1,* or optionally together at utility server *14,* is in a web-enabled format suitable for display, such as HTML or XML. Figure 5 de-

picts an example of an online bill that shows the customer name *17*, the customer address *18*, the quantity of energy *19*, the total amount due *20*, and the payment options *21*, *22*, and *23*.

[0055] Figure 6 gives an example of the type of data that may be displayed in a web page at AMR *1*. The data identifies the device location and the types of information that are displayed. In this example, the display includes the AMR device ID, meter specific data, customer data such as the physical address of meter *25*, the energy types descriptors *26*, and the tabular data showing the energy usage *27* and the time stamp *28*, which gives the hour as a number from 1 to 24, starting at midnight.

[0056] Figure 7 illustrates the three possible modes for operating this invention. In the Server Mode, the AMR device *1* reads the energy data and sends this data to the utility server *14* which then computes and displays the energy usage data online at the utility's server *14*. In the Client Mode, the AMR device *1* reads the energy data, computes the billing information, and displays the data as a webpage at the AMR device *1* itself. In the Client Mode, the AMR device behaves as a micro-server. Finally, in the Hybrid Mode, the invention operates as a hybrid which combines both

the Server Mode and the Client Mode and the data is available at both the utility server and the AMR device simultaneously.

[0057] Referring to Figure 8, the Server Mode is described by the following steps:

[0058] 1. The meter data is read by AMR *1*.

[0059] 2. The energy use data *27*, is sent via the ISP *3* and internet *4* to the company server *14*.

[0060] 3. The company server *14* selects the appropriate billing algorithm *13*, an example of which is shown in Figure 11.

[0061] 4. The company server *14* computes the bill *15* using a calculation process similar to that shown in Figure 12.

[0062] 5. The bill data *15* is converted into a web enabled format including but not limited to HTML or XML code.

[0063] 6. The bill data *15* is displayed on the utility website as an online bill.

[0064] 7. The process loops continuously from step 1 through 6 to provide real time updating of bill data for all AMR devices connected to each specific utility server and saving the data in a relational database.

[0065] 8. The customers *6, 7* log on to the website.

[0066] 9. The customer *6* reads the bill online using standard

browsers, ftp, email or other communicative formats.

[0067] 10. The customer pays the bill *15* online or pays the bill offline via other channels like the mail.

[0068] Referring to Figure 9, the Client Mode is described by the following steps:

[0069] 1. The meter data is read by AMR *1*.

[0070] 2. The energy use data *27*, is stored at AMR *1*.

[0071] 3. The billing program *12* is part of the software installed at AMR *1*.

[0072] 4. AMR *1* computes the bill data *15* using a calculation process similar to that shown in Figure 12.

[0073] 5. The bill data *15* is converted into web enabled format including but not limited to HTML or XML code.

[0074] 6. The bill data *15* is displayed as a webpage as shown in Figure 6 at AMR *1* available for viewing online.

[0075] 7. The bill data *15* is transferred via the internet to the utility enterprise server *14* where the data is available for archival and backup purposes in relational databases.

[0076] 8. The customers *6* logs on to the internet to view the bill.

[0077] 9. The customer *6* reads the bill similar to the example shown in Figure 5 online using standard browsers, ftp, email, or other communicative formats.

[0078]   10. The customer pays the bill *15* online or pays the bill offline via other channels, such as the mail.

[0079]   Referring to Figure 10, the Hybrid Mode is a combination of the Server Mode and the Client Mode simultaneously, where both locations provide all the information related to the computation and display of the AMR data. The following steps describe the Hybrid Mode:

[0080]   1. The meter data is read by AMR *1*.

[0081]   2. The energy use data *27* is stored at AMR *1*.

[0082]   3. The billing program *12* is also part of the software installed at AMR *1*.

[0083]   4. AMR *1* computes the bill data *15* using a calculation process similar to that shown in Figure 12.

[0084]   5. The energy usage data *27* is transmitted to the utility server *14* and stored.

[0085]   6. The computed data is *15* is stored at the utility server *14* and also stored at AMR *1*.

[0086]   7. The real time bill data *15* is then displayed at the IP address *5* of AMR *1*.

[0087]   8. The data available at the utility server *14* is a compilation of data from all AMR devices under control by this particular server. The server loops through all the AMR

devices until all the meter information is collected and finally archived in relational databases.

[0088] A typical customer billing algorithm used by a utility company is shown in Figure 11.

[0089] An example of the procedure for calculating a published utility bill for a residential customer with typical usage numbers is shown in Figure 12.

[0090] Figure 13 shows a system with a visual liquid crystal display (LCD) window to provide information to the customer.

[0091] Although the present invention has been described in terms of various embodiments, it is not intended that the invention be limited to these embodiments. Modifications within the spirit of this invention will be readily apparent to those skilled in the field. For example, since the billing data is available on a microserver connected to the internet in real time, various means of interaction from email, to file transfer protocols (FTP) and other communicative processes can be used to access update and transfer the billing data.